

204070" 9246E00T

Figure 1(a) 6" x 6" setup reticle for the preferred embodiment (10 x 12 field point array)

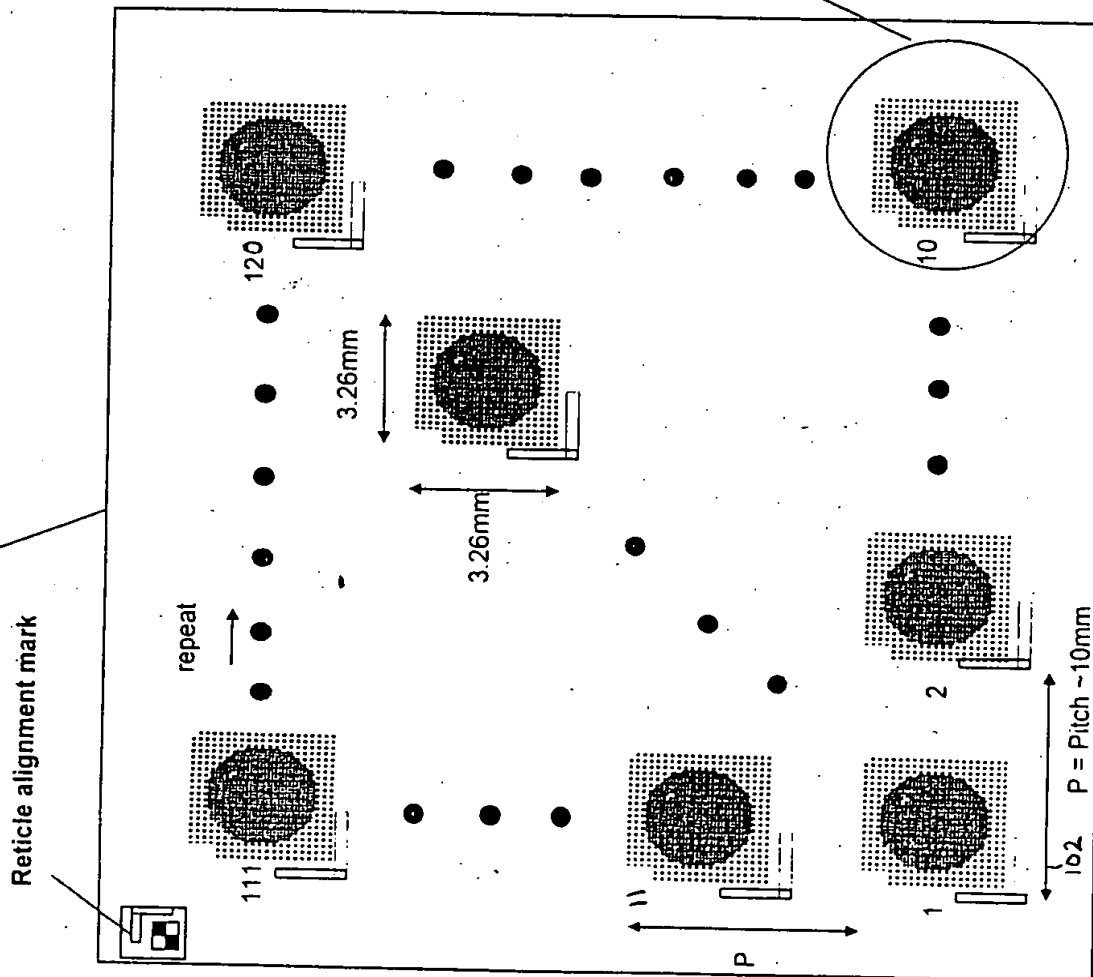


Figure 1(b) side view of preferred setup reticle plate

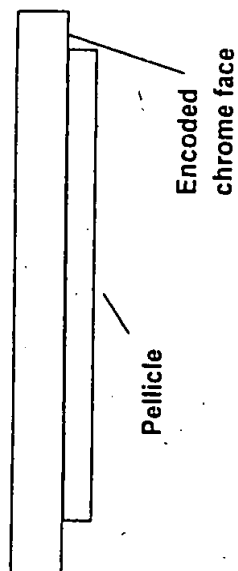
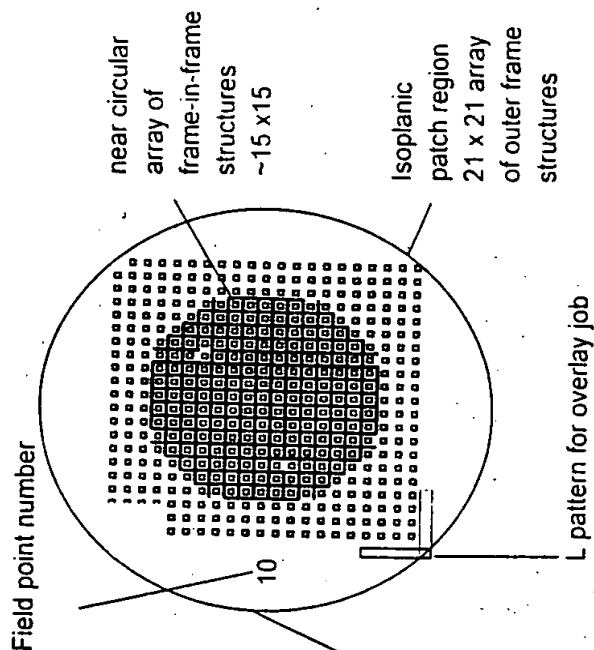


Figure 1(c) - detail of field point



mm = millimeters, um = microns

Figure 1(d) Preferred embodiment - typical wafer level exposure pattern

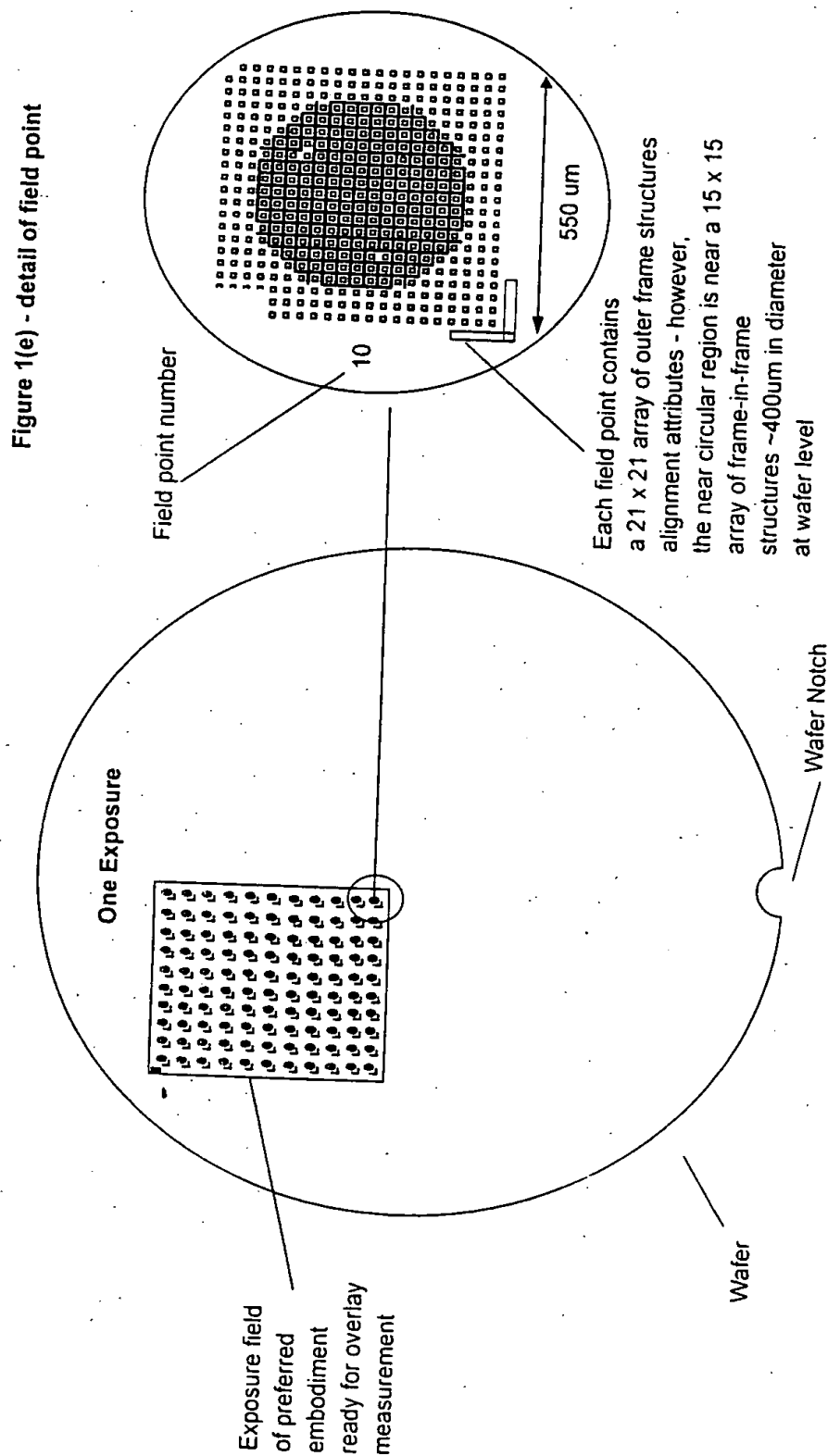


Figure 2(a) Prior Art Printed ISI reticle image (two exposures) from U.S. Patent 5,978,085 – one field point

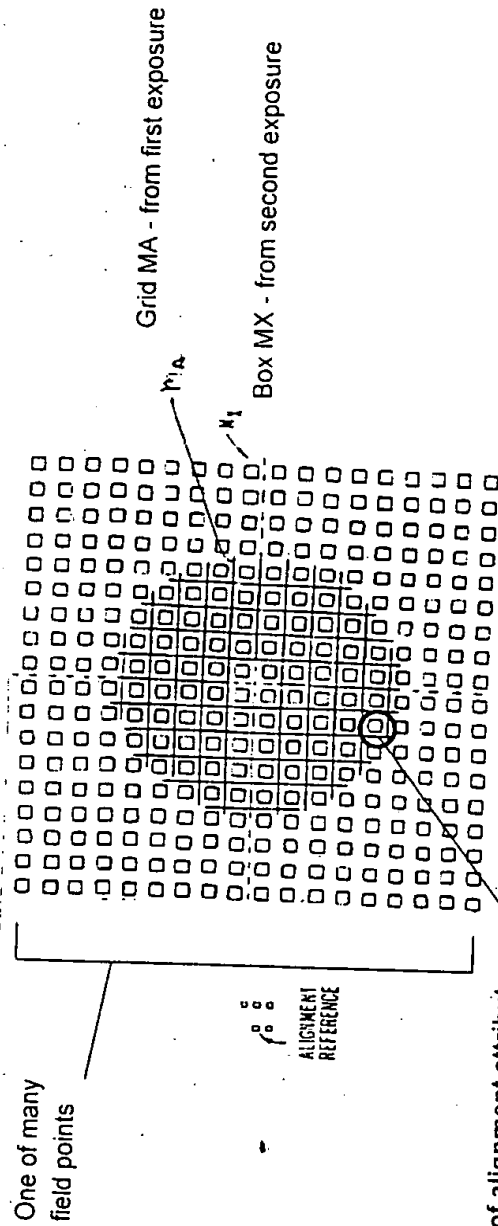
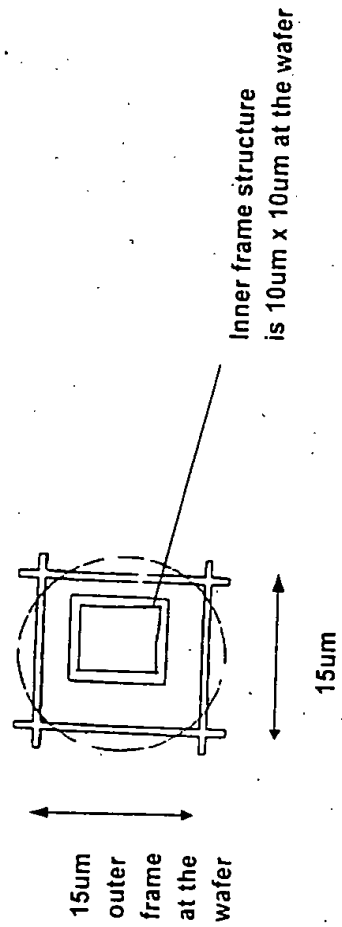
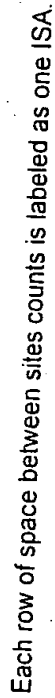


Figure 2(b) close-up view of alignment attribute

p' = pitch of the frame-in-frame
overlay targets is 40um
at the wafer



Y coordinate label



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Near circular

Yes

X coordinate label

Figure 4(a) Site arrays of field points
55,56,65,66 for the preferred embodiment

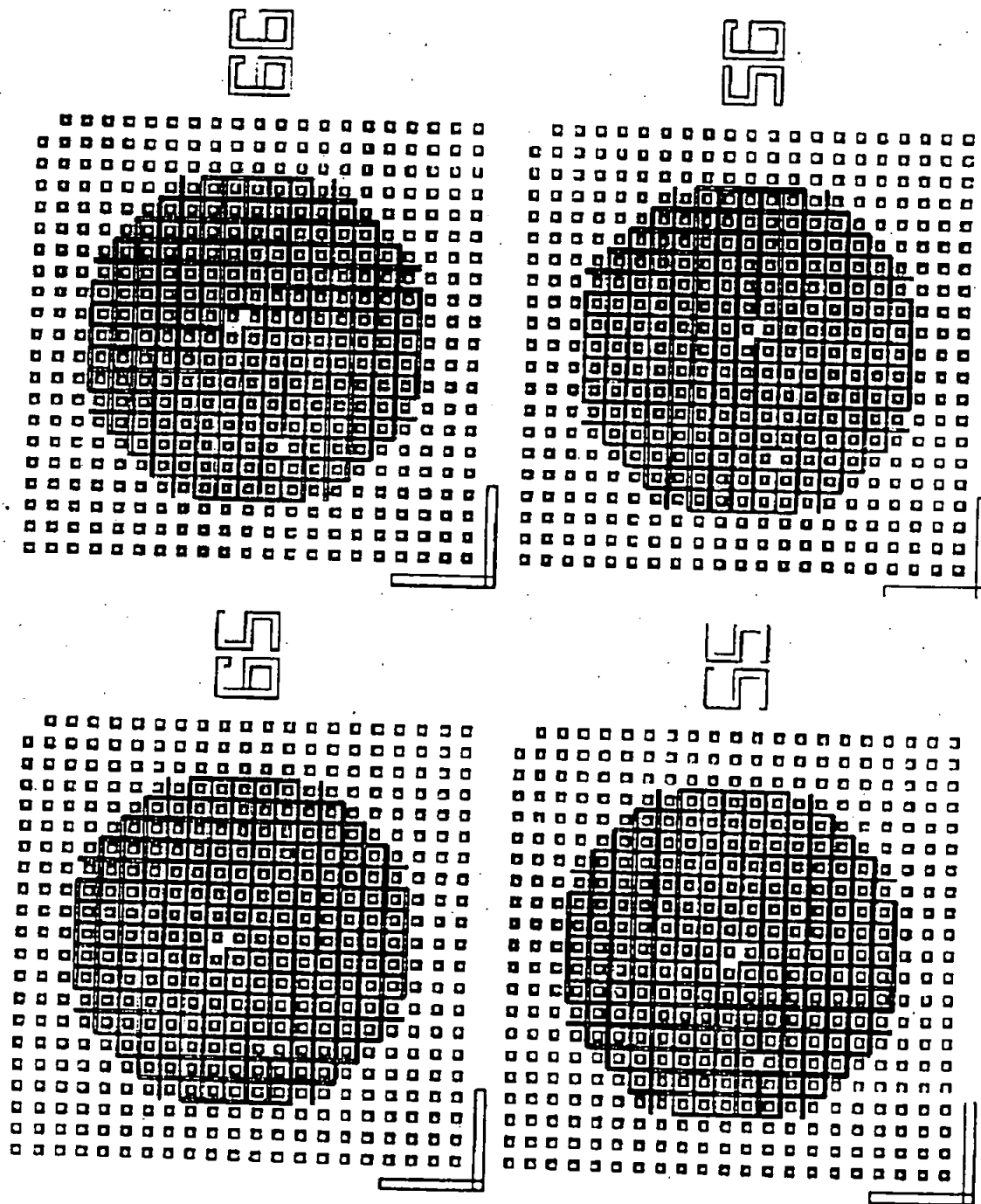


Figure 4(b) Field Point coordinate array diagram

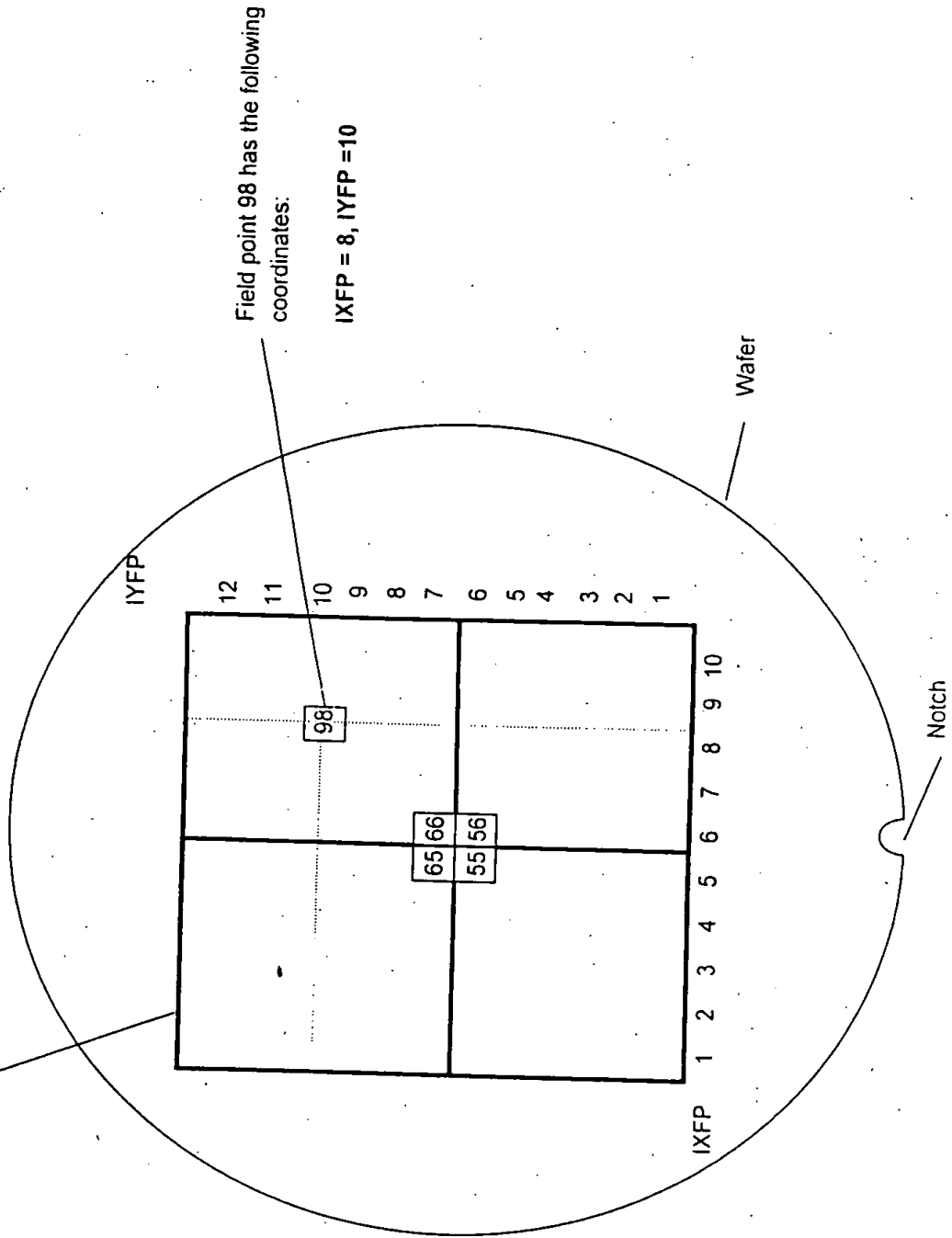


Figure 5(a) Sign convention for BBX and BBY offsets and fourth encoding scheme at wafer level
The small inner frame is shown mis-aligned to the larger outer frame this produces
an x-shift and y-shift overlay positional offset (+BBX and +BBY)

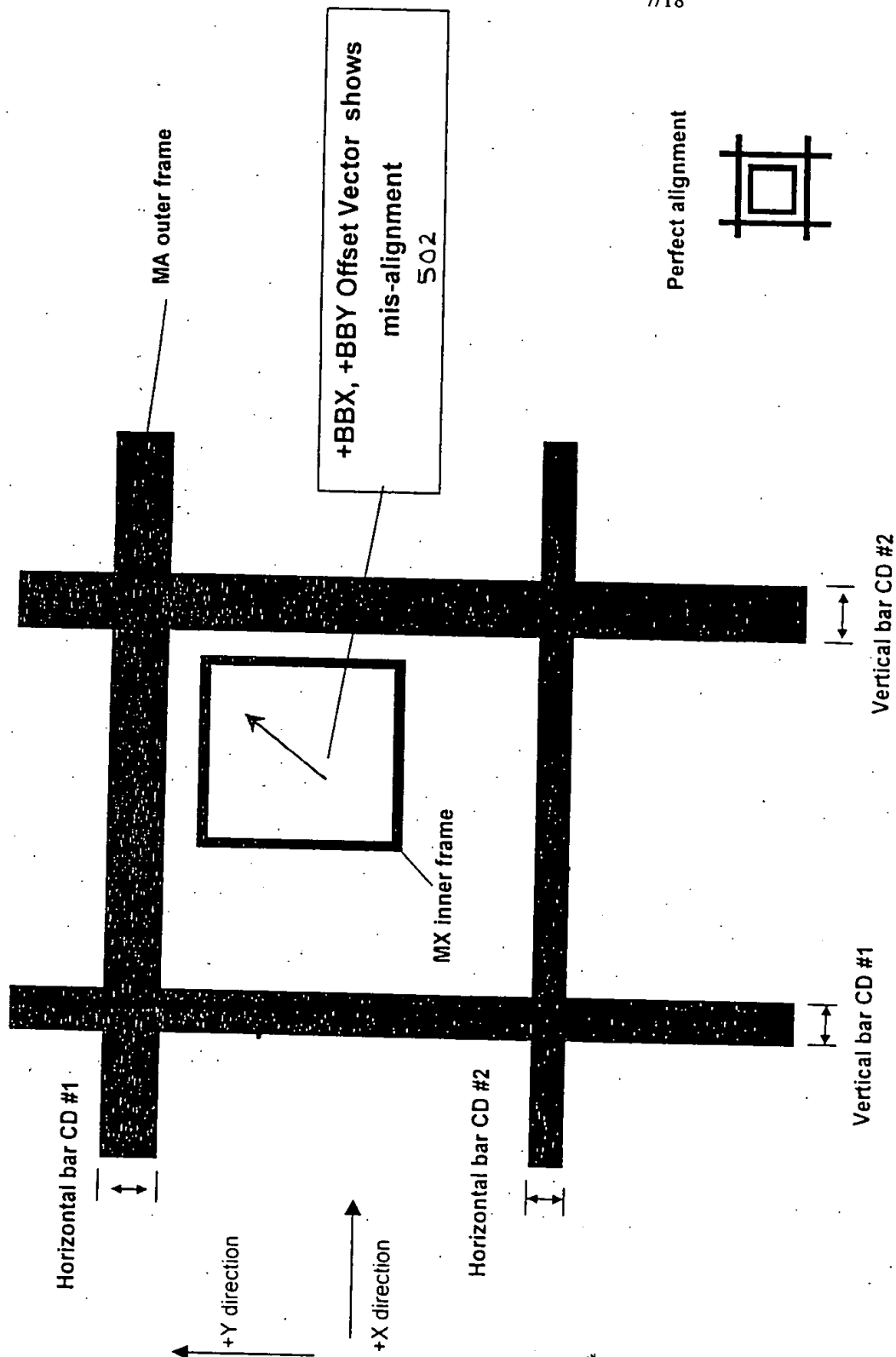
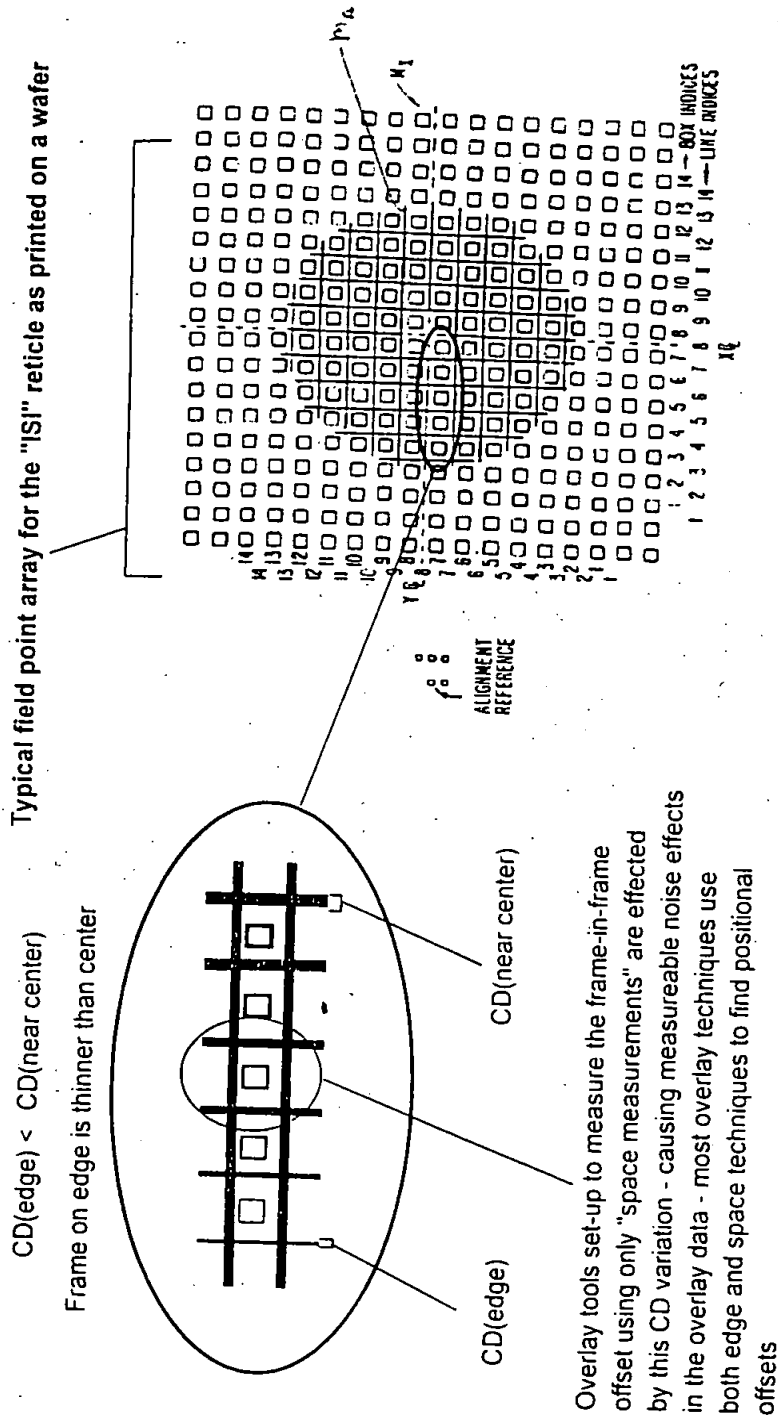
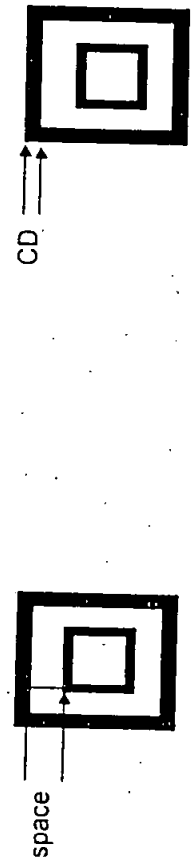


Figure 5(b) Typical Overlay errors



Overlay measurements using space techniques Overlay measurements using CD or edge techniques



Prior Art

Figure 5d, Bar in box or frame in box
measurement producing non zero offset in
presence of CD variation ($CDL > CDR$).

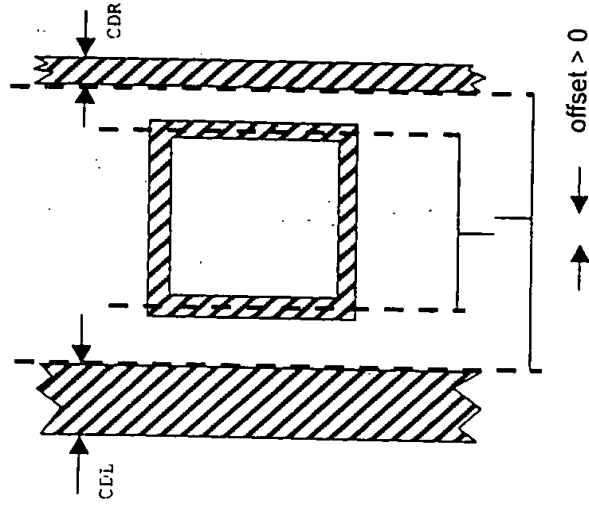
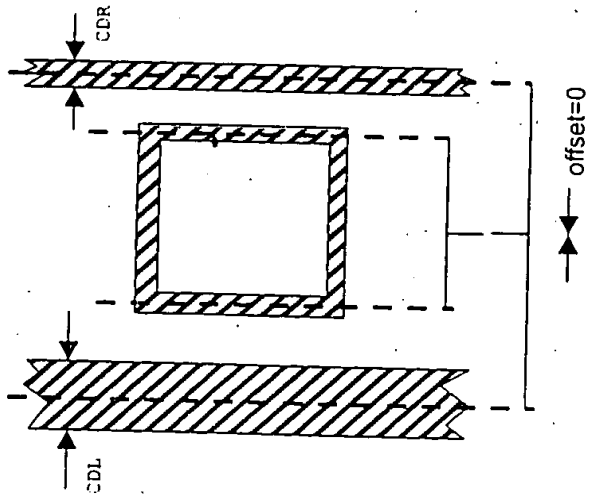


Figure 5c, Bar in bar or frame in frame
measurement producing 0 offset in presence of
CD variation ($CDL > CDR$).



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Every field point has the exact same single missing horizontal bar taken from an outer frame structure.

Second Encoding Scheme

Each field point has a **different** missing double bar pattern taken from the outer frame structures

For example,

Here the vertex missing bar is located at ISAY= 5 and between ISAX = 3 and ISAX = 4.

The horizontal missing bar is located at $ISX = 4$ and between $ISAY = 4$ and $ISAY = 5$

11-11-11

FP =

11/18

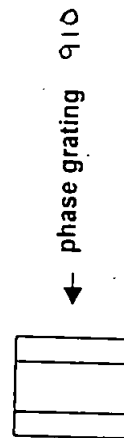
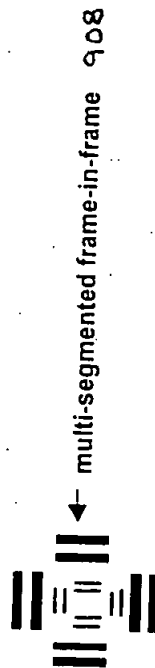
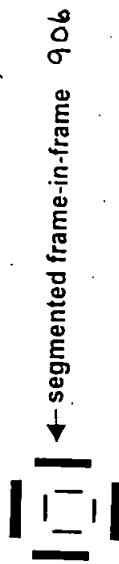
BBx
BBy

Figure 8 location of (0,0) point of frame-in-frame data on setup-reticle

IX0 = position within 21 x 21 array where (BBx,BBy) = (0,0) occurs
 IY0
 FP = field point number

1Y=Row	1	2	3	4	5	6	7	8	9	10
12	7	8	9	10	11	12	13	14	15	16
	17	17	17	17	17	17	17	17	17	17
	111	112	113	114	115	116	117	118	119	120
11	7	8	9	10	11	12	13	14	15	16
	16	16	16	16	16	16	16	16	16	16
	101	102	103	104	105	106	107	108	109	110
10	7	8	9	10	11	12	13	14	15	16
	15	15	15	15	15	15	15	15	15	15
	91	92	93	94	95	96	97	98	99	100
9	7	8	9	10	11	12	13	14	15	16
	14	14	14	14	14	14	14	14	14	14
	81	82	83	84	85	86	87	88	89	90
8	7	8	9	10	11	12	13	14	15	16
	13	13	13	13	13	13	13	13	13	13
	71	72	73	74	75	76	77	78	79	80
7	7	8	9	10	11	12	13	14	15	16
	12	12	12	12	12	12	12	12	12	12
	61	62	63	64	65	66	67	68	69	70
6	7	8	9	10	11	12	13	14	15	16
	11	11	11	11	11	11	11	11	11	11
	51	52	53	54	55	56	57	58	59	60
5	7	8	9	10	11	12	13	14	15	16
	10	10	10	10	10	10	10	10	10	10
	41	42	43	44	45	46	47	48	49	50
4	7	8	9	10	11	12	13	14	15	16
	9	9	9	9	9	9	9	9	9	9
	31	32	33	34	35	36	37	38	39	40
3	7	8	9	10	11	12	13	14	15	16
	8	8	8	8	8	8	8	8	8	8
	21	22	23	24	25	26	27	28	29	30
2	7	8	9	10	11	12	13	14	15	16
	7	7	7	7	7	7	7	7	7	7
	11	12	13	14	15	16	17	18	19	20
1	7	8	9	10	11	12	13	14	15	16
	6	6	6	6	6	6	6	6	6	6
	1	2	3	4	5	6	7	8	9	10

Figure 9 Typical overlay patterns
or completed alignment attributes



Prior Art

Figure 10 Photolithographic stepper or scanner system

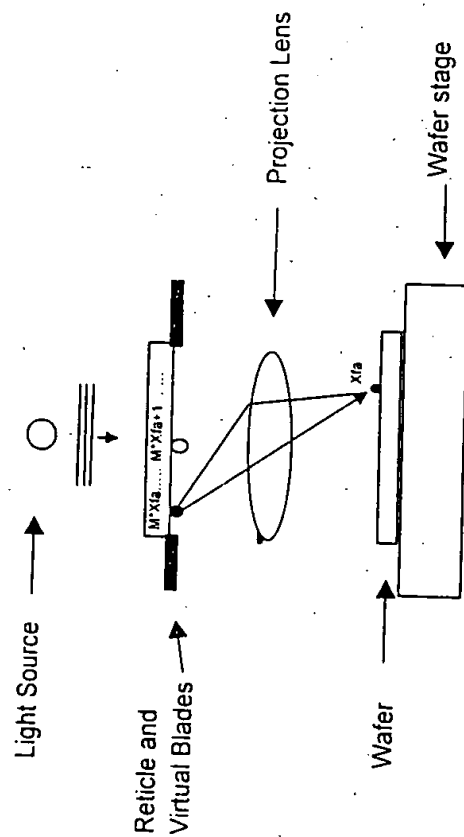


Figure 11 Process flow for a method of verifying proper order of a job deck.

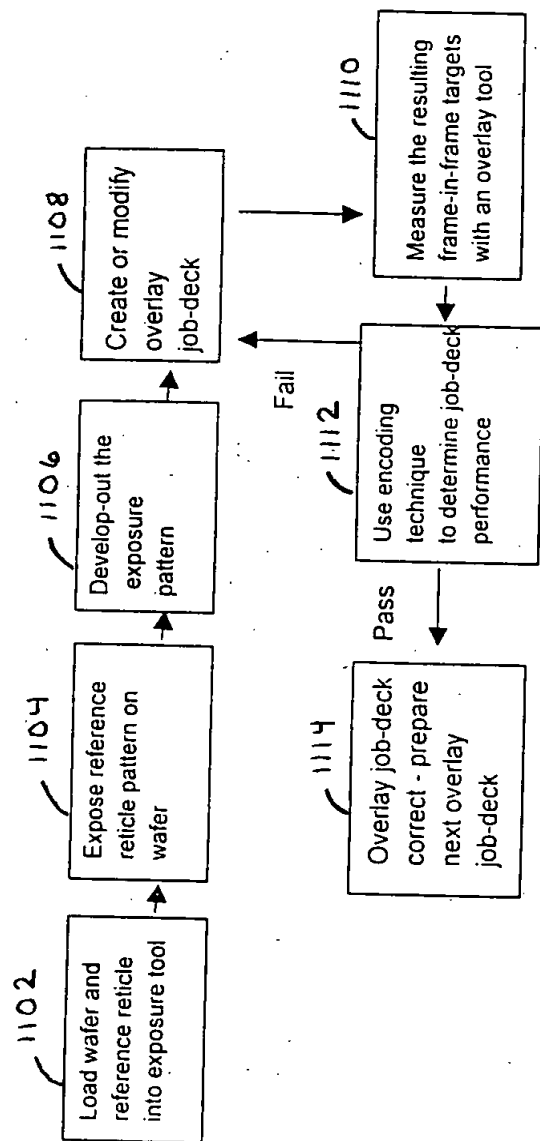


Figure 12 Reticle and resist frame-in-frame description for a typical ISA coordinate site ISAX, ISAY

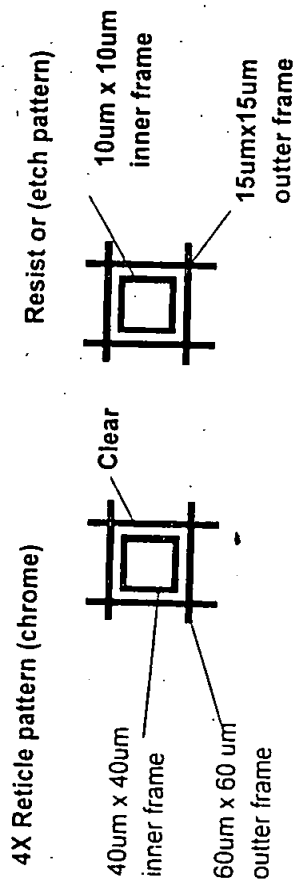


Figure 13 Centered
Frame-in-Frame structure
No shift: ISAX = 0, ISAY = 0

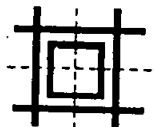
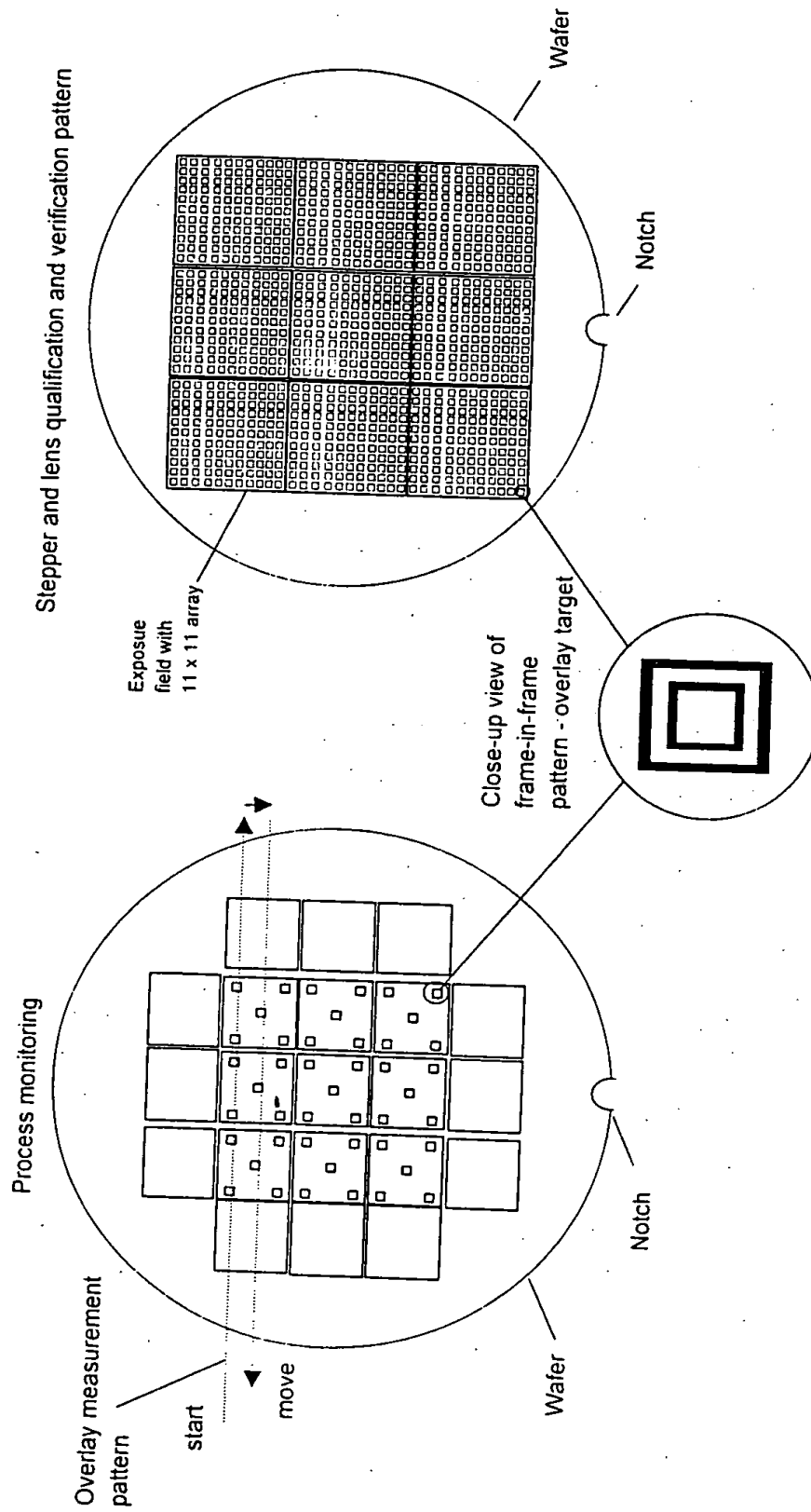


Figure 14 Prior art - exposure patterns: Process monitoring and Stepper qualification



Prior Art

Figure 15(a) Process flow for prior art - Photolithographic tool set-up

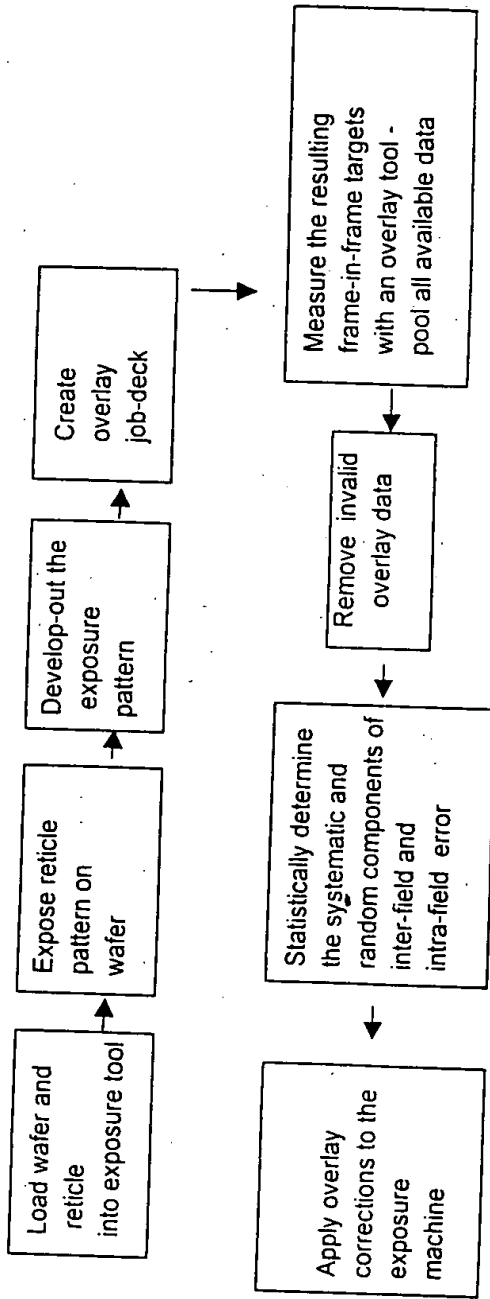


Figure 15(b) Process flow for prior art - Production use of overlay

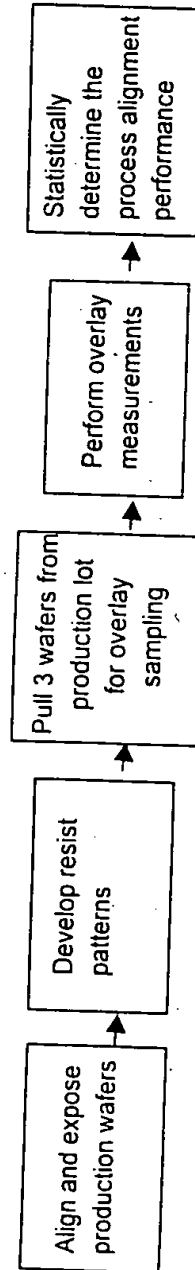


Figure 15(c) Process flow for prior art - lens aberration measurement

